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**Name of Organization:** Wisconsin Department of Natural Resources

**Type of Organization:** State

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**Project Title:** Physical Sediment Assessment - Sheboygan River Inner Harbor

**Project Category:** Contaminated Sediments

**Rank by Organization (if applicable):** 6

**Total Funding Requested (\$):** 220,000 **Project Duration:** 1.5 Years

**Abstract:**

Contaminated sediments in the Sheboygan River Superfund Site have been debated and studied now for the better part of twenty years. Yet, not one study has looked at how sediment moves, or doesn't move, within the Sheboygan Inner Harbor. Regulators make the claim that high-flow events in the Sheboygan River are sure to resuspend and transport significant amounts of polychlorinated biphenyls (PCBs); responsible parties counter by arguing that sediment, once deposited on the harbor bottom, is there for good. There is no reliable site-specific information to justify either claim. This project, therefore, will quantify elevation changes in the sediment bed of the Sheboygan River Inner Harbor through direct observations and through numerical modeling. This information will be used to identify the potential to scour the inner harbor sediments and consequent transport high PCB concentrations buried at depth. This information is necessary to make remedial decisions that will meet the Sheboygan River RAP and LaMP needs and priorities. Ultimately, the study must provide information to justify the remedial action and remedial design for sediments in the Sheboygan Inner Harbor.

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**Geographic Areas Affected by the Project**

**States:**

<input type="checkbox"/> Illinois	<input type="checkbox"/> New York
<input type="checkbox"/> Indiana	<input type="checkbox"/> Pennsylvania
<input type="checkbox"/> Michigan	<input checked="" type="checkbox"/> Wisconsin
<input type="checkbox"/> Minnesota	<input type="checkbox"/> Ohio

**Lakes:**

<input type="checkbox"/> Superior	<input type="checkbox"/> Erie
<input type="checkbox"/> Huron	<input type="checkbox"/> Ontario
<input checked="" type="checkbox"/> Michigan	<input type="checkbox"/> All Lakes

**Geographic Initiatives:**

<input type="checkbox"/> Greater Chicago	<input type="checkbox"/> NE Ohio	<input type="checkbox"/> NW Indiana	<input type="checkbox"/> SE Michigan	<input type="checkbox"/> Lake St. Clair
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**Primary Affected Area of Concern:** Sheboygan River, WI

**Other Affected Areas of Concern:**

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***For Habitat Projects Only:***

**Primary Affected Biodiversity Investment Area:**

**Other Affected Biodiversity Investment Areas:**

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**Problem Statement:**

The International Joint Commission (IJC), United States Environmental Protection Agency (U.S. EPA), and Wisconsin Department of Natural Resources (WDNR), have targeted the Sheboygan River Area Of Concern (AOC), as one of the forty-three AOCs requiring remedial action. The WDNR, with active participation by stakeholders, developed the Sheboygan River Remedial Action Plan (RAP), which identified the impaired uses in the Sheboygan River AOC. The impaired waterway uses that this project will provide critical information towards addressing in the Sheboygan River AOC are:

- Restrictions on Fish and Wildlife Consumption
- Degradation of Fish and Wildlife Populations
- Fish Tumors and Other Deformities
- Bird or Animal Deformities or Reproduction Problems
- Degradation of Benthos
- Restrictions on Dredging Activities
- Loss of Fish and Wildlife Habitat

Progress towards removing these impaired uses in the Sheboygan River AOC will help us towards meeting the Lake Michigan Lakewide Management Plan (LaMP) goal of restoring the integrity of the Lake Michigan Ecosystem.

Contaminated sediments in the Sheboygan River Superfund Site have been debated and studied now for the better part of twenty years. Yet, not one study has looked at how sediment moves, or doesn't move, within the Sheboygan Inner Harbor. Regulators make claim that high-flow events in the Sheboygan River are sure to resuspend and transport significant amounts of polychlorinated biphenyls (PCBs); responsible parties counter by arguing that sediment, once deposited on the harbor bottom, is there for good. There is no reliable site-specific information to justify either claim.

This work will result in a definitive, quantitative assessment regarding the potential for resuspension and transport of sediment from the Inner Harbor area. This work will evaluate potential sediment transport for a number of scenarios, including the following:

- No Action
- Partial dredging with cap
- Complete removal (dredging) with cap

Our approach will focus on data collection, analysis and numerical simulation to answer the following questions:

1. What is the maximum anticipated depth of scour in the Sheboygan River for high-flow events, high-wind events, and high-wave events?
2. Where is this scour projected to occur?
3. What is the probability of occurrence of these high-scour events?
4. How would proposed remedial actions influence sediment and contaminant transport?

This project will be conducted in three phases, as detailed below in the Proposed Work/Outcome section.

#### **Proposed Work Outcome:**

This project will be conducted in three phases.

Phase One: Data Collection.

1. Monthly hydrographic surveys (April-November).
2. Upstream flow and suspended sediment measurement.
3. Sediment coring.
4. Sediment annular flume testing.
5. Current meter deployment.
6. Wave gage deployment.

The purpose of this proposed data collection is to:

- Document changes in sediment bed elevation over time;
- Provide data for input and verification so that a 2-D numerical model can be developed and applied.

Phase Two: Model Development and Calibration.

This phase of the project involves applying a 2-dimensional hydrodynamic and sediment transport model to the Sheboygan Inner Harbor area. A 2-dimensional model is one in which changes in important parameters (i.e. resuspension of solids) can be simulated both bank-to-bank, as well as upstream to downstream. A 1-dimensional model, such as that used at other sites for sediment transport modeling, are very useful at the planning level. However, a 1-dimensional model cannot address the variability of sediments and the complex interaction between wind, waves, and river flows.

Examples of applicable models include HydroQual's ECOM-SED model, and EPA's Environmental Fluid Dynamics Code (EFDC). The model framework ultimately chosen will include mechanisms for wave and wind-induced sediment resuspension as well as for flow-induced resuspension.

Specific tasks for this phase include:

1. Develop 2-D model grid. Model grids will be developed using the results of hydrographic surveying, and will extend from the mouth of the Outer Harbor to the Waelderhaus Dam. This upstream extent is needed in order to develop appropriate upstream boundary conditions for the model.
2. Develop model initial conditions and boundary conditions. Model initial conditions for sediment will be developed based on historical and collected data. Upstream boundary conditions will be based on a sediment-discharge rating curve at the Waelderhaus Dam.
3. Test hydrodynamic and sediment transport models against available data. This step (commonly referred to as a "calibration"), will compare model output to measured water flow velocities, stages, suspended sediment concentrations, and sediment bed elevations. Model parameters (i.e. friction factor, resuspension potential, etc.) will be adjusted in order to yield an acceptable calibration. "Acceptable calibration" can be defined similar to that used in the Fox River Mass Balance Model Evaluation Workgroup Tech Memo series.
4. Apply calibrated hydrodynamic and sediment transport model to likely remediation scenarios. This step will test the depth of scour of sediments under a number of likely remediation scenarios, including "No Action" and "Partial Dredging

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with Cap". The outcome of this step will be a series of maps indicating predicted erosion and deposition rates under various atmospheric and hydrodynamic conditions.

Phase Three: Data and Model Result Interpretation and Reporting.

This phase will result in a report and presentation materials summarizing the results of the data collection and model application. Project deliverables will be elaborated on if this project is selected.

**Project Milestones:**

**Dates:**

Project Start - Phase 1: Data Collection

04/2001

Complete Phase 1: Data Collection

11/2001

Begin Phase 2: Model Develop. & Calib.

12/2001

Complete Phase 2:

05/2002

Begin Phase 3: Interpretation & Report

06/2002

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Project End - Complete Phase 3

10/2002

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☐ Project Addresses Environmental Justice

**If So, Description of How:**

☐ Project Addresses Education/Outreach

**If So, Description of How:**

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<b>Project Budget:</b>		
	<b>Federal Share Requested (\$)</b>	<b>Applicant's Share (\$)</b>
Personnel:	0	0
Fringe:	0	0
Travel:	0	0
Equipment:	0	0
Supplies:	0	0
Contracts:	220,000	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	220,000	0
Indirect Costs:	0	0
Total:	220,000	0
Projected Income:	0	0

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**Funding by Other Organizations (Names, Amounts, Description of Commitments):**

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**Description of Collaboration/Community Based Support:**

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